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Valuation, personal taxes, and dividend policy under passive debt management

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Abstract

We derive consistent valuation models in accordance with the flow to equity and adjusted present value approaches under passive debt management considering the firm's dividend policy and differentiated personal taxes at the equity investor level. The valuation models include a blended personal tax rate encapsulating all the effects resulting from retention and cash dividends. Furthermore, we establish appropriate adjustment formulas for the relationship between the firm's unlevered and levered cost of equity necessary for the unlevering and relevering of beta factors. Finally, we show with simulations that dividend policy significantly affects the equity market value.

Keywords Valuation · Personal taxes · Passive debt management · Financing policy · Dividend policy · Share repurchases · Cost of equity · Simulations

JEL Classification G32 · H20 · M41

1 Introduction

Since debt financing provides a corporate tax advantage, the choice of a firm's financing policy between passive or active debt management affects the value of tax shields and, thus, firm value (Miles and Ezzell 1980, 1985; Modigliani and Miller 1958, 1963).¹ Thereby, passive debt management is characterized by predetermined debt levels, whereas active debt management presumes predetermined capital structure targets in future periods.

¹ Modigliani and Miller (1958, 1963) and Miles and Ezzell (1980, 1985) abstract from personal taxes. For an overview of active and passive debt management, see Appleyard and Dobbs (1997). A combination of active and passive debt management is developed in Dierkes and Schäfer (2016).

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Besides financing policy, dividend policy, as the choice for distributing or retaining cash flows, also affects equity market value. The relevance of the dividend policy on equity market value lies in the fact that distributed cash flows are taxed at the cash dividend tax rate, whereas retained cash flows are taxed at the different effective capital gains tax rate. In the past, the tax rate on realized capital gains used to be indeed lower than that on cash dividends. Nowadays, tax systems in the USA and numerous other countries, such as Germany, equally tax cash dividends and realized capital gains. However, because investments in shares are usually long term, the corresponding capital gains are normally not realized immediately. Hence, capital gains taxes can be deferred, resulting in a tax advantage compared to cash dividend taxes (Berk and DeMarzo 2024; Brealey et al. 2022).² In the literature, we find some valuation models for this situation under passive debt management, but they lack a sound and consistent theoretical foundation for incorporating the dividend policy (e.g., Amoako-Adu 1983; Dempsey 2017; Rashid and Amoako-Adu 1987, 1995). Furthermore, some of these models use a blended tax rate depending on the payout ratio and personal tax rates, but its determination and relationship to the cost of equity remain unclear. Therefore, we present in this paper a valuation model considering differentiated personal tax rates and a payout ratio under passive debt management, which has not yet been developed in the literature.

A starting point for integrating personal taxes in valuation models are the studies of Farrah and Selwyn (1967) and Myers (1967). The literature most closely related to dividend policy in consideration of differentiated personal tax rates at the equity investor level starts with the study of Amoako-Adu (1983). The author assumes as we do that the cash flow available for distribution is distributed to equity investors by a predetermined payout ratio, while the remaining cash flow is retained by the firm. He derives a valuation model according to the adjusted present value (APV) approach, assuming passive debt management and a steady state with new investments equivalent to the depreciations. Subsequently, Rashid and Amoako-Adu (1987) only extend the existing APV approach of Amoako-Adu (1983) by an inflation-based growth of all relevant values, accordingly not recognizing additional real growth. Moreover, Rashid and Amoako-Adu (1995) derive an adjustment formula for the cost of equity, which is consistent with the derived market value of tax shields in their 1987 study. Consequently, it is also possible to apply the flow to equity (FtE) approach. However, we show that the valuation models of Rashid and Amoako-Adu (1987, 1995) contain inconsistencies regarding the effective capital gains tax rate, resulting from the assumption of a steady state with an inflation-based growth of all relevant values. Note that an explicit forecast period is neither analyzed by Amoako-Adu (1983) nor by Rashid and Amoako-Adu (1987, 1995).

The study published by Dempsey (2017) develops different discounting techniques for the various DCF models with personal taxes. Specifically, he derives the weighted average cost of capital and the cost of equity under both passive and active debt management according to the debt adjustment assumptions of Harris and Pringle (1985). Moreover, he shows that the different DCF models yield the same equity market value, given an explicit forecast period. Concerning the personal taxation of equity investors, recent studies assume, as Dempsey, a blended personal tax rate on cash dividends and capital gains (Sick 1990; Taggart 1991). In particular, Dempsey (2017, pp. 3–4) writes: “For simplicity of exposition, q_E is defined here as a single value for a particular firm that encapsulates the mix of how the firm chooses between retentions to equity, dividends, and stock

² The optimal dividend policy would imply that a firm pays no cash dividends at all. However, cash dividends are created because of signaling effects and other reasons (Arditti et al. 1976; Black 1976).

repurchases.” Hence, the assumption of a blended personal tax rate serves as a simplification as it keeps the valuation models tractable. However, it remains an open question how such a blended personal tax rate is determined, and, consequently, it is unclear how to apply the valuation models.

A following study by Diedrich et al. (2023) analyzes valuation with personal taxes and share repurchases with a similar valuation model. But in contrast to our analysis, they assume active and not passive debt management. Furthermore, they do not analyze the consequences of the dividend policy on the blended tax rate, so the relationship to the models using a blended tax rate remains unclear. Nevertheless, the presented procedure of using a blended tax rate can be transferred to their valuation model with active debt management.

The contribution of this study to the literature is threefold. First, we develop the valuation model of a firm under passive debt management, which distributes part of its cash flow as cash dividends and retains the other part. The retained cash flow is assumed to be used for share repurchases (Rashid and Amoako-Adu 1987, 1995). The consideration of two different equity investor tax rates on cash dividends and effective capital gains leads to the derivation of a blended personal tax rate, which depends on the dividend policy of the firm. Second, the effects of the dividend policy on the cost of equity are disclosed by deriving appropriate adjustment formulas for passive debt management. Both the explicit forecast period and steady state phase are analyzed. Specifically, our derived adjustment formula for the steady state differs from that of Rashid and Amoako-Adu (1995), who do not account for the effective capital gains tax rate consistently. The FtE and APV approaches developed by Dempsey (2017) can be converted into the FtE and APV approaches derived in this study under the assumptions of passive debt management and a uniform blended personal tax rate, but the usefulness of these valuation models is limited because of the unspecified blended tax rate. In contrast, we clarify the determination of the blended personal tax rate and, furthermore, we analyze the resulting consequences on the cost of equity. Finally, the relevance of our derived valuation model is illustrated by using numerical examples and simulations compared to a valuation model with the full distribution of the FtE to equity investors. Specifically, the simulations show that neglecting the dividend policy leads to an average underestimation of equity market value of 7.6% under otherwise identical assumptions. Overall, the main results of this study are consistent valuation models that allow accounting for a firm’s dividend policy and passive debt management in light of differentiated personal taxes at the equity investor level.

The remainder of this paper is structured as follows. In Sect. 2, the valuation model of the unlevered firm is presented. Then, the valuation model of the levered firm is developed according to the FtE approach under passive debt management in Sect. 3. Subsequently, we derive the market value of tax shields and adjustment formulas for the cost of equity of the levered firm in Sect. 4. In Sect. 5, we present numerical examples and simulation results for the valuation differences under different dividend policies. As we conduct our analysis under the assumption of riskless debt, like other basic studies analyzing the effects of financing strategies on valuation, we discuss the main consequences of integrating the risk of default in Sect. 6. Finally, Sect. 7 concludes the paper with a summary of the main results and an outlook on further research.

2 Valuation model for the unlevered firm

We divide the forecast horizon of the cash flow into an explicit forecast period and a subsequent steady state. In the steady state, all relevant variables increase at a nominal growth rate g , which considers an inflation-based growth and/or real growth (Friedl and Schwetzler 2010; Penman 2013). We assume an all-equity financed firm. The expected free cash flow, $E[\widetilde{FCF}_t]$, in period $t = 1, 2, \dots$ is given. Generally, the firm will not distribute the full free cash flow as cash dividends to equity investors, but only a certain percentage of it. This might be due to several reasons, such as exploiting the tax advantage of retained over distributed cash flows.³ Therefore, the management of a firm sets a deterministic payout ratio, $r_t \leq 1$, in period t , which is related to the free cash flow. Consequently, the expected cash dividend, $E[\widetilde{Div}_t^u]$, of the unlevered firm is calculated as:⁴

$$E[\widetilde{Div}_t^u] = r_t \cdot E[\widetilde{FCF}_t], \quad \text{for } t = 1, \dots, T, \tag{1}$$

where T depicts the end of the explicit forecast period. In the presence of personal taxes, distributed and retained cash flows have different tax implications. The proportion of the free cash flow, r_t , which is distributed to equity investors, is taxed at the cash dividend tax rate, τ_d . The residual $(1 - r_t)$ of the free cash flow is retained by the firm. We follow Rashid and Amoako-Adu (1987, 1995) and Diedrich et al. (2023) in assuming the retained free cash flows are used for share repurchases to maintain the independence of investment and financing decisions. Alternatively, one could assume value-neutral investments of the retained cash flows, which has no effect on the equity value, but then the financing policy affects the investment policy. Hence, we assume share repurchases of the retained free cash flows leading to stock price appreciation and are thus taxed at the effective capital gains tax rate, τ_g . The cash dividend and effective capital gains tax rates are not assumed to vary across equity investors and time. Regarding their magnitude, we expect $\tau_d > \tau_g$ due to the possible deferral of capital gains taxes. Under the common assumption that capital gains correspond to changes in market value (e.g., Clubb and Doran 1992; Cooper and Nyborg 2008; Diedrich et al. 2023), the expected market value of the unlevered firm, $E[\widetilde{V}_{t-1}^u]$, in period $t - 1$ is determined under a recursive approach, as follows:

$$E[\widetilde{V}_{t-1}^u] = \frac{\overbrace{r_t \cdot E[\widetilde{FCF}_t]}^{\text{cash dividends}} \cdot (1 - \tau_d) + \overbrace{(1 - r_t) \cdot E[\widetilde{FCF}_t]}^{\text{retained free cash flows used for share repurchases}} \cdot (1 - \tau_g) - \tau_g \cdot \overbrace{(E[\widetilde{V}_t^u] - E[\widetilde{V}_{t-1}^u]) + E[\widetilde{V}_t^u]}^{\text{change in market value}}}{1 + ke^u}, \quad \text{for } t = 1, \dots, T. \tag{2}$$

The given cost of equity for the unlevered firm after personal taxes equals ke^u is constant over time. Note that Eq. (2) is consistent with prior research (Samuelson 1964). Thus, with a uniform personal tax rate, the cost of equity without personal taxes is obtained by dividing the cost of equity with personal taxes ke^u to one minus the uniform personal tax rate.

Apparently, the taxation of changes in market value in (2) leads to a circularity problem because the market value in period $t - 1$ is included in the tax base for the taxation of capital gains. However, this problem is overcome by solving Eq. (2) for the expected market

³ For the reasons and effects of cash dividends and share repurchases, see e.g. Gopal et al. (2024), Grullon and Michaely (2004), Jacob and Jacob (2013), Jakob and Valta (2023), Maxwell and Stephens (2003), Ren et al. (2024), and Saxana and Sahoo (2023).

⁴ All random variables are denoted by a tilde.

value in period $t - 1$. Additionally, dividing the numerator and denominator by $(1 - \tau_g)$ leads to:

$$E[\tilde{V}_{t-1}^u] = \frac{E[\widetilde{FCF}_t] \cdot (1 - \tau_{E,t}^r) + E[\tilde{V}_t^u]}{1 + ke^{u*}}, \quad \text{for } t = 1, \dots, T, \quad (3)$$

where $\tau_{E,t}^r = r_t \cdot (\tau_d - \tau_g) / (1 - \tau_g)$ represents the blended personal tax rate and $ke^{u*} = ke^u / (1 - \tau_g)$ the modified cost of equity of the unlevered firm. In contrast to Die-drich et al. (2023), the blended personal tax rate $\tau_{E,t}^r$ considers all effects resulting from retentions and cash dividends due to the differentiated personal taxation of cash dividends and capital gains. To obtain the blended personal tax rate, $\tau_{E,t}^r$, we need to modify the unlevered cost of equity, ke^u and, consequently, use ke^{u*} when applying Eq. (3).⁵ Under different tax rates for cash dividends and effective capital gains, Eq. (3) indicates that the higher the payout ratio, r_t , is, the higher the blended personal tax rate, $\tau_{E,t}^r$, is and, consequently, the lower the firm market value. Note that the increase in firm market value only stems from the differences in personal tax rates regarding cash dividends and effective capital gains (Rashid and Amoako-Adu 1987). Therefore, if $\tau_d = \tau_g$, Eq. (3) corresponds to Miller and Modigliani's (1961) dividend policy irrelevance result and transforms into a valuation model without personal taxes.

Given a steady state, all expected values (e.g., EBIT and capital expenditures) increase at a constant and uniform growth rate, g . Accordingly, the expected market value of the unlevered firm also increases at this growth rate in (3) and, hence, $E[\tilde{V}_t^u] = E[\tilde{V}_{t-1}^u] \cdot (1 + g)$. Consequently, we obtain the market value of the unlevered firm in the steady state as:

$$E[\tilde{V}_T^u] = \frac{E[\widetilde{FCF}_{T+1}] \cdot (1 - \tau_E^r)}{ke^{u*} - g}, \quad (4)$$

where payout ratio r is constant and, therefore, $\tau_E^r = r \cdot (\tau_d - \tau_g) / (1 - \tau_g)$ holds. In the case of a cash dividends-only strategy with a payout ratio $r = 1$, the blended tax rate is highest resulting in the lowest market value of the unlevered firm. Conversely, a share repurchases-only strategy with $r = 0$ yields to the highest market value. In the latter case, the blended tax rate is zero and the impact of personal taxes depends only on the effective capital gains tax rate reflected in the modified cost of equity. Accordingly, we can analyze the effects of a cash dividends or share repurchases-only strategy in a period in the explicit forecast period. Overall, the market value of the unlevered firm can be determined with Eqs. (3) and (4) over an explicit forecast period and a subsequent steady state, accounting for the firm's dividend policy in light of the differentiated personal taxes at the equity investor level.

3 Valuation model for the levered firm

Henceforth, we assume passive debt management, which is characterized by predetermined debt levels, D_{t-1} , in period $t = 1, 2, \dots$. In the steady state, all relevant values increase at a constant and uniform growth rate, g , so that this growth also holds for debt levels and,

⁵ In this context, it remains an open question how the blended personal tax rate is determined by Dempsey (2017). Thus, the modification of the cost of equity is not calculated. Consequently, it is not possible to use the blended personal tax rate without modifying the cost of equity.

consequently $D_{T+1} = D_T \cdot (1 + g)$. To analyze the effects of the dividend policy on valuation with personal taxes under passive debt management on a sound theoretical basis, in the first step, we do not consider the risk of default comparable to other basic studies of valuation approaches under different financing strategies (e.g., Miles and Ezzell 1985; Dierdrich et al. 2023). Therefore, the cost of debt, kd , corresponds to the risk-free interest rate, which is constant over time. In Sect. 6, we discuss the consequences of the relaxations of this assumption on the developed valuation approaches. Furthermore, we assume a constant corporate tax rate, τ , which is independent of the amount of taxable income. Interest on debt is fully deductible from taxable income (e.g., Miles and Ezzell 1980; Modigliani and Miller 1963).

We start our analysis of valuation of the levered firm with the FtE approach, because the payout ratio refers to the flow to equity. Furthermore, we need the FtE valuation formula to derive formulas to adjust the cost of equity to financial leverage. The derivation of these adjustment formulas in the explicit forecast period and steady state is essential, as they form the basis for unlevering and relevering of beta factors. This also requires the determination of the equity market value and market value with the APV approach, which is analyzed in the next section.

Following the argumentation in the preceding section, the expected cash dividend of the levered firm, $E[\widetilde{Div}_t^\ell]$, is calculated as:⁶

$$E[\widetilde{Div}_t^\ell] = r_t \cdot E[\widetilde{FtE}_t], \quad \text{for } t = 1, \dots, T, \tag{5}$$

where the expected FtE, $E[\widetilde{FtE}_t]$, is defined as $E[\widetilde{FtE}_t] = E[\widetilde{FCF}_t] - kd \cdot (1 - \tau) \cdot D_{t-1} + \Delta D_t$, with $\Delta D_t = D_t - D_{t-1}$ as the change in debt market value over period t . As the debt market value is deterministic in each period under the assumption of passive debt management, FtE can be determined without circularity problems. Then, the expected equity market value, $E[\widetilde{E}_t^\ell]$, is:

$$E[\widetilde{E}_{t-1}^\ell] = \frac{\overbrace{r_t \cdot E[\widetilde{FtE}_t]}^{\text{cash dividends}} \cdot (1 - \tau_d) + \overbrace{(1 - r_t) \cdot E[\widetilde{FtE}_t]}^{\text{retained flow to equity used for share repurchases}} \cdot (1 - \tau_g) - \tau_g \cdot \overbrace{(E[\widetilde{E}_t^\ell] - E[\widetilde{E}_{t-1}^\ell]) + E[\widetilde{E}_t^\ell]}^{\text{change in market value}}}{1 + ke_t^\ell}, \quad \text{for } t = 1, \dots, T, \tag{6}$$

where ke_t^ℓ depicts the cost of equity for the levered firm. Note that Eq. (6) is similar to (2), but refers to the expected FtE. Solving the circularity problem and dividing the numerator and denominator by $(1 - \tau_g)$, we obtain:

$$E[\widetilde{E}_{t-1}^\ell] = \frac{E[\widetilde{FtE}_t] \cdot (1 - \tau_{E,t}^r) + E[\widetilde{E}_t^\ell]}{1 + ke_t^{\ell*}}, \quad \text{for } t = 1, \dots, T, \tag{7}$$

where $ke_t^{\ell*} = ke_t^\ell / (1 - \tau_g)$ depicts the modified cost of equity of the levered firm. Equation (7) is identical with Eq. (8) in Dempsey (2017) for $q_E = 1 - \tau_{E,t}^r$ and $K_{E,i} = ke_t^{\ell*}$

⁶ We expect that payout ratios r_t and r are identical for the levered and unlevered firms.

⁷ Thus, Eq. (8) in Dempsey (2017) and Eq. (7) differ regarding the specification of the blended personal tax rate and levered cost of equity. In particular, the blended personal tax rate q_E in Dempsey (2017) is not defined and unspecified.⁸ Therefore, the blended personal tax rate, $\tau_{E,i}^r$, allows accounting for the dividend policy of the firm resulting from the different personal tax rates at the equity investor level. Similar to the calculation of the modified cost of equity of the unlevered firm in the preceding section, the use of the blended tax rate, $\tau_{E,i}^r$, in Eq. (7) requires a corresponding modification of the levered cost of equity, ke_i^{ℓ} . As Dempsey (2017) does not specify the blended tax rate, q_E , the modification of the levered cost of equity, $K_{E,i}$, is also not taken into account. In this respect, the relation between $K_{E,i}$ and the blended value of q_E is not revealed by Eq. (8) in Dempsey (2017).

Given a steady state, we obtain:

$$E[\tilde{E}_T^{\ell}] = \frac{E[\widetilde{FtE}_{T+1}] \cdot (1 - \tau_E^r)}{ke^{\ell*} - g}, \quad (8)$$

where $ke^{\ell*} = ke^{\ell} / (1 - \tau_g)$.⁹ Admittedly, Eqs. (7) and (8) cannot be used, because the costs of equity of the levered firm, ke_i^{ℓ} and ke^{ℓ} , are yet to be determined in the explicit forecast period and steady state. The key component for the derivation of adjustment formulas for the cost of equity is the market value of tax shields, which is determined in the next section.

4 Market value of tax shields and cost of equity

To derive tax shields, we sum the FtE and flow to debt after personal taxes of the levered firm and subtract the free cash flow after personal taxes of the unlevered firm. As, under passive debt management, the debt market value, D_{t-1} , is deterministic and assumed not to contain any default risk and the payout ratio, r_t , is also deterministic, the appropriate discount rate for the tax shields is the risk-free interest rate after personal taxes, $kd \cdot (1 - \tau_b)$, for all periods. Accordingly, we obtain the market value of tax shields, VTS_{t-1} , in the explicit forecast period (see Appendix 1 for details):¹⁰

⁷ Note that index i in $K_{E,i}$ denotes the corresponding period. When comparing Eq. (7) with Eq. (8) in Dempsey (2017), we note that the expected FtE in (7) can also be determined as:

$$E[\widetilde{FtE}_t] = \overbrace{E[\widetilde{EBIT}_t]}^{E[\widetilde{FCF}_t]} \cdot (1 - \tau) + E[\widetilde{Q}_t] - E[\widetilde{I}_t] - kd \cdot (1 - \tau) \cdot D_{t-1} + \Delta D_t, \text{ with } E[\widetilde{Q}_t] \text{ as the expected non-cash adjustments and } E[\widetilde{I}_t] \text{ as expected investments.}$$

⁸ In Dempsey (2017), the job of converting cash flows to market values is allocated to blended value q_E , which is rather unusual when dealing with DCF models. Accordingly, Dempsey defines his cost of equity, $K_{E,i}$, as market expected growth rate. However, do note that this does not alter the comparison.

⁹ Multiplying the numerator and denominator in (8) by $(1 - \tau_g)$ shows that, for $g = \pi$, with π as the inflation rate, the growth rate in Eq. (6) in Rashid and Amoako-Adu (1995) is not multiplied by one minus the effective capital gains tax rate. In this respect, Rashid and Amoako-Adu (1995) refer also to a blended personal tax rate, $\tau_E^{RA,r}$, defined as $\tau_E^{RA,r} = r \cdot \tau_d + (1 - r) \cdot \tau_g$ (similar to Cooper and Nyborg 2004). The difference from our derived personal tax rate results because the relation between the levered cost of equity and the blended personal tax rate is neither disclosed by Rashid and Amoako-Adu (1995) nor by Cooper and Nyborg (2004).

¹⁰ For the determination of the tax shield under active debt management, see Diedrich et al. (2023). The determination of the tax shield in the steady state without growth can be found in, e.g., Chang and Rhee (1990), Lin and Fleming (2013), and Miller (1977).

$$VTS_{t-1} = \frac{(\tau \cdot kd \cdot D_{t-1} - kd \cdot D_{t-1} + \Delta D_t) \cdot (1 - r_t \cdot \tau_d - (1 - r_t) \cdot \tau_g)}{1 + kd \cdot (1 - \tau_b)} + \frac{kd \cdot D_{t-1} \cdot (1 - \tau_b) - \Delta D_t \cdot (1 - \tau_g) - \tau_g \cdot (VTS_t - VTS_{t-1}) + VTS_t}{1 + kd \cdot (1 - \tau_b)}, \text{ for } t = 1, \dots, T, \tag{9}$$

where τ_b is the constant personal tax rate on interest for all debt investors. Therefore, we presume three different personal tax rates on cash dividends, interest, and effective capital gains.¹¹ Solving (9) for VTS_{t-1} , rearranging terms, and dividing the numerator and denominator by $(1 - \tau_g)$ yields:

$$VTS_{t-1} = \frac{\overbrace{\tau \cdot kd \cdot D_{t-1} \cdot (1 - \tau_{E,t}^r)}^{\text{corporate tax shield}}}{1 + kd \cdot (1 - \tau_{b^*})} - \frac{\overbrace{kd \cdot D_{t-1} \cdot (\tau_{b^*} - \tau_{E,t}^r)}^{\text{debt interest tax shield}}}{1 + kd \cdot (1 - \tau_{b^*})} - \frac{\overbrace{\Delta D_t \cdot \tau_{E,t}^r}^{\text{change in debt tax shield}}}{1 + kd \cdot (1 - \tau_{b^*})} + \frac{VTS_t}{1 + kd \cdot (1 - \tau_{b^*})}, \text{ for } t = 1, \dots, T, \tag{10}$$

where $\tau_{b^*} = (\tau_b - \tau_g) / (1 - \tau_g)$ is the modified personal tax rate at the debt investor level. Equation (10) shows the market value of tax shields can be split into three parts. The corporate tax shield results from the tax deductibility of interest in corporate tax base accounting for the dividend policy of the firm and personal taxes. This tax shield is known from the valuation calculation without personal taxes. The debt interest tax shield and the change in the debt tax shield as the second and third part relate to the different personal taxations of equity and debt investors. Regarding the debt interest tax shield, equity investor tax rates are affected by the payout ratio, while the debt investor tax rate is not. The change in the debt tax shield relates to the different personal taxation of the changes in debt market value, thus connecting the debt issue and redemption to higher or lower distributed or retained cash flows. It is worth noting that the debt issue and redemption are not subject to the personal taxation of debt investors. However, the change in debt market value is tax-relevant for equity investors (e.g., Dempsey 2017). In case of growth of the firm, generally, $\Delta D_t > kd \cdot (1 - \tau) \cdot D_{t-1}$ holds and, consequently, Eq. (10) indicates that the higher the payout ratio, r_t , is, the smaller are the modified tax shields in period t (see Appendix 2 for further details).¹²

In the steady state, we obtain (see Appendix 3):

$$VTS_T = D_T \cdot \left(1 - \frac{(kd \cdot (1 - \tau) - g) \cdot (1 - \tau_{E,T}^r)}{kd \cdot (1 - \tau_{b^*}) - g} \right). \tag{11}$$

Equation (11) indicates that, in general, the higher the payout ratio, r , is, the higher are the modified tax shields (see, again, Appendix 2). Hence, similar to higher debt levels, higher distributions increase the modified tax shields in (11). Consequently, in the case of a dividends-only strategy with $r = 1$ the market value of tax shields is highest, and in the case of a share repurchases-only strategy with $r = 0$ the market value of tax shields is lowest. Compared to the value

¹¹ In several European countries, the tax rates on cash dividends and interests are identical and, thus, $\tau_b = \tau_d$.

¹² Note that Eq. (10) is identical to Eq. (21) in Dempsey (2017) for $q_E = 1 - \tau_{E,t}^r$, $q_D = 1 - \tau_{b^*}$, $r_D = kd$, and $K_{CTB} = kd \cdot (1 - \tau_{b^*})$. In Dempsey's (2017) study, K_{CTB} serves as the risk-adjusted discount rate for tax shields in Eq. (21). Consequently, when assuming passive debt management and risk-free debt, K_{CTB} equals the risk-free interest rate after modifying personal taxes, $kd \cdot (1 - \tau_{b^*})$. Similar to the previous section, the modified personal tax rate of debt investors, τ_{b^*} , results when deriving the blended personal tax rate, $\tau_{E,t}^r$.

effect of the payout ratio, r , on the modified tax shields in the case of growth of the firm in (10), the increase of the modified tax shields in the steady state due to a higher payout ratio r in (11) is rather counterintuitive in the case of a higher cash dividend tax rate compared to the effective capital gains tax rate.

According to the APV approach, we can now determine firm market value by first determining the market value of the unlevered firm (Eqs. (3) and (4)), and then the market value of tax shields (Eqs. (10) and (11)) in the explicit forecast period and subsequent steady state. To determine equity market value, we subtract debt market value from firm market value.

Linking Eq. (3) with Eqs. (7) and (10), we can derive the levered cost of equity, ke_t^{ℓ} , in period t in the explicit forecast period (see Appendix 4 for details):

$$ke_t^{\ell} = ke^u + (ke^u - kd \cdot (1 - \tau_b)) \cdot \frac{D_{t-1} - VTS_{t-1}}{E[\tilde{E}_{t-1}^{\ell}]}, \quad \text{for } t = 1, \dots, T. \quad (12)$$

Provided that the firm is in a steady state and thus substituting Eq. (11) in (12), we obtain:

$$ke^{\ell} = ke^u + (ke^u - kd \cdot (1 - \tau_b)) \cdot \frac{(kd \cdot (1 - \tau) - g) \cdot (1 - \tau_E^r)}{kd \cdot (1 - \tau_b) - g} \cdot L(r), \quad (13)$$

where $L(r) = D_T / E[\tilde{E}_T^{\ell}]$. When multiplying the numerator and denominator in (13) by $(1 - \tau_g)$, it becomes obvious that the adjustment formula in Rashid and Amoako-Adu's (1995) Eq. (7) does not account for the effective capital gains tax rate consistently as, for $g = \pi$, with π as the inflation rate, the growth rate is not multiplied by one minus the effective capital gains tax rate.

As the unlevering of beta factors is usually conducted assuming solely a steady state, the derivation of asset betas according to the reformulation of Eq. (13) requires information about the payout ratios of reference companies. In this regard, note that leverage $L(r)$ in Eq. (13) is dependent on payout ratio r , as the cash dividend tax rate exceeds the effective capital gains tax rate. Concerning the effect of the dividend policy on the levered cost of equity, an interesting result is that the level of the levered cost of equity, ke^{ℓ} , in the steady state is independent of the level of payout ratio r according to Eq. (13). This is because with, for example, a higher payout ratio, r , τ_E^r increases and $(kd \cdot (1 - \tau) - g) \cdot (1 - \tau_E)$ accordingly decreases; however, $L(r)$ increases because $E[\tilde{E}_T^{\ell}]$ decreases. Remarkably, the two opposite value effects cancel each other out.¹³ This is even more surprising as, intuitively, with a higher payout ratio, r , the more the levered cost of equity should increase due to the higher tax payments equity investors are obligated to from the difference in the cash dividend and effective capital gains tax rates (Rashid and Amoako-Adu 1987). Specifically, the adjustment formula in (13) is identical for $g = 0$, $q_E = 1 - \tau_E^r$, $q_D = 1 - \tau_b^*$, $K_U = ke^u$, $K_E = ke^{\ell}$, and $K_D = r_D \cdot q_D = kd \cdot (1 - \tau_b^*)$ with Eq. (25) in Dempsey (2017).¹⁴ Eventually, the derived adjustment formulas in (12) and (13) resemble those developed by Modigliani and Miller (1958, 1963) and Miles and Ezzell (1980, 1985). Starting from the

¹³ This is because the blended personal tax rate, τ_E^r , cancels out of the adjustment formula in (13). However, note that this simplification results in an adjustment formula with unobservable input parameters, which causes difficulties when it comes to the unlevering of beta factors in valuation practice. For details, see Appendix 5.

¹⁴ The substitution of Eq. (13) in (24) from Dempsey (2017) and solving for K_E leads to: $K_E = K_U + (K_U - r_D \cdot q_D) \cdot (1 - \alpha) \cdot \frac{\Theta}{1 - \Theta}$, with $\alpha = 1 - \frac{(1 - \tau) \cdot q_E}{q_D}$ and $\Theta = D_T / E[\tilde{V}_T^{\ell}]$, which is identical to Eq. (25) in Dempsey (2017) for $K_D = r_D \cdot q_D$.

cost of equity, ke^u , which depicts operating risk, a risk premium is added to incorporate financial risk.

Given adjustment formulas (12) and (13), the FtE approach is also applicable. However, as the adjustment formulas require the equity market value as input parameter, the application of (7) and (8) indicates circularity problems. These circularity problems easily can be solved using a common spreadsheet software. Therefore, it is understandable, that despite the advantage of a circularity-free valuation with the APV approach, the use of the FtE approach is very common in valuation practice.

5 Illustration of the implications of dividend policy on equity market value

In this section, we examine how the valuation results vary depending on the level of payout ratio r . For this, we compare a firm with a dividends-only strategy fully distributing the FtE to its equity investors ($r = 1$) with a firm retaining part of its FtE ($r < 1$) for share repurchases. We first show a simple numerical example assuming a steady state with increasing expected values at a nominal growth rate, g . Firm 1 sets a payout ratio of 100% and firm 2 of 50%. The other assumptions hold for both firms:

$$\begin{aligned} g &= 1\%; \quad \tau = 30\%; \quad \tau_d = \tau_b = 25\%; \quad \tau_g = 12.5\%; \quad kd = 5\% \\ ke^u &= 10\%; \quad D_0 = 2000, E[\widetilde{FCF}_1] = 500 \end{aligned} \quad (14)$$

We avoid the circularity problem associated with the FtE approach by first valuing the firm according to the APV approach. Subsequently, leverage is known and we can value the firm according to the FtE approach. The conducted valuations according to the APV approach for firms 1 and 2 lead to the results in Table 1.

The market value of the unlevered firm is calculated according to Eq. (4). Obviously, the unlevered firm's market value increases with decreasing payout ratio r due to the higher cash dividend tax rate compared to the effective capital gains tax rate. The market value of tax shields is computed according to Eq. (11). Interestingly, the higher the payout ratio, r , is, the more the market value of tax shields increases. Hence, the market value of tax shields has a weakening effect on the personal tax advantage of retained cash flows compared to cash dividends. Eventually, the equity market value is calculated as the sum of the market values of the unlevered firm and of tax shields minus debt market value. Overall, Table 1 illustrates that equity market value is higher, the lower payout ratio r is. Consequently, the higher the payout ratio, r , is, the higher is the leverage.

From Eq. (8), the equity market value can be directly determined according to the FtE approach for firms 1 and 2. For the calculation of the levered cost of equity (Eq. (13)), we use the leverage in Table 1. The results of the application of the FtE approach are summarized in Table 2.

We note that in the case of a steady state the levered cost of equity is independent of the level of the payout ratio r . Eventually, we obtain the same equity market values as under the APV approach.

Table 1 Application of the APV approach

APV approach	Firm 1 ($r = 100\%$)	Firm 2 ($r = 50\%$)
Free cash flows after blended personal taxes	429	464
Market value of the unlevered firm	4110	4452
Market value of tax shields	696	587
Equity market value	2805	3039
Leverage	71%	66%

To illustrate the implications of dividend policy on the equity market value for a more general setting, we use simulations. We assume two firms in a steady state. Firm 1, with a dividends-only strategy, sets again a deterministic payout ratio of 100%. Consequently, the calculation of the equity market value, $E_0^{\ell, r=1}$, for firm 1 according to the FtE approach can be simplified to:

$$E_0^{\ell, r=1} = \frac{E[\widetilde{FtE}_1] \cdot (1 - \tau_E^{r=1})}{ke^{\ell^*} - g}, \quad (15)$$

where $\tau_E^{r=1} = (\tau_d - \tau_g) / (1 - \tau_g)$.¹⁵ As we calculate the same levered cost of equity independently of the level of the payout ratio, r , we can also use Eq. (13) for determining the modified levered cost of equity, ke^{ℓ^*} , in (15).

For firm 2, we assume payout ratio r to be drawn from a uniform distribution, $r \in [5\%;95\%]$. To obtain an indication of the average expected valuation difference between firms 1 and 2, 1,000,000 valuation cases were simulated. We determine the percentage valuation difference in terms of equity market value if Eq. (15) is used instead of Eq. (8), with $r \in [5\%;95\%]$. In this case, the percentage valuation difference p is calculated as:

$$p = \frac{E_0^{\ell, r=1} - E_0^{\ell}}{E_0^{\ell}} = \frac{(1 - r) \cdot (\tau_d - \tau_g)}{r \cdot (\tau_d - \tau_g) + \tau_g - 1} < 0. \quad (16)$$

The equity investor tax rates are assumed to have the same values as those in the above numerical example (see (14)). Based on these assumptions, the conducted simulation leads to the frequency distribution of the percentage valuation difference in Fig. 1.

If (15) applies instead of (8), with $r \in [5\%;95\%]$, the equity market value is always underestimated under our assumptions. The average valuation underestimation is approximately 7.6%, while the minimum and maximum valuation underestimations are 0.8% and 13.7%. From Eq. (16), the valuation underestimation increases with a decreasing payout ratio r and with the increasing difference between the cash dividend and effective capital gains tax rates. Eventually, the simulation results show that the assumption of a full distribution of the FtE to equity investors severely underestimates equity market value and emphasizes the relevance of our valuation model, especially for low payout ratios.

¹⁵ Note that $1 - \tau_E^{r=1}$ equals $(1 - \tau_d) / (1 - \tau_g)$ in footnote 1 in Dempsey (2017).

Table 2 Application of the FtE approach

FtE approach	Firm 1 ($r = 100\%$)	Firm 2 ($r = 50\%$)
FtE after blended personal taxes	386	418
Levered cost of equity	14.75%	14.75%
Equity market value	2805	3.39

6 Integration of risk of default

Our analysis focused on deriving valuation approaches with personal taxes and share repurchases under passive debt management. Like other basic studies analyzing the effect of financing strategies on valuation, we have not integrated the risk of default to ensure a sound theoretical foundation (e.g., Clubb and Doran 1995; Diedrich et al. 2022; Diedrich et al. 2023; Miles and Ezzell 1980). Nevertheless, it is essential, from a theoretical and practical perspective, to clarify the integration of risk of default in the valuation approaches. The theoretical basis for its integration is the trade-off theory according to the capital structure results from balancing the financial distress costs and tax benefits (e.g., Berk and DeMarzo 2024; Brealey et al. 2022; Myers 1974).¹⁶ The most pragmatic solution to consider the risk of default in valuation is to use a risk-adjusted cost of debt instead of the risk-free interest rate for calculating the tax shields and discounting the risk-free part of the tax shields. Accordingly, our analysis can be easily modified by inserting the risk-adjusted cost of debt for the risk-free interest rate (e.g., Brealey et al. 2022; Clubb and Doran 1995; Inselbag and Kaufhold 1997).

Nevertheless, there exist a lot of theoretical approaches to consider the risk of bankruptcy and the associated costs of financial distress in more detail, and the fundamental approaches and theories can be found in nearly every valuation book. For example, it is possible to design binomial models for a firm that can go bankrupt with an exogenous probability. In the case of bankruptcy, different scenarios, like total and partial liquidation, are possible (e.g., Almeida and Philippon 2008). In addition, the models differ in the existence of tax payments caused by the gain from writing off bonds (e.g., Sick 1990). As main consequences of risky debt, you have to differentiate between the cost of debt and the contractual interest rate for debt with consequences on the suitable cost of capital for discounting future tax shields and the weighted average cost of capital for discounting free cash flows. The integration of personal taxes in valuation models with risky debt leads to further problems caused by the dependency of personal taxes on the dividend tax rate and capital gains tax rate (e.g., Cooper and Nyborg 2008; Molnár and Nyborg 2013; Sick 1990; Taggart 1991). Apart from binomial models, there are other models to analyze the effects of the risk of default on valuation, e.g., trinomial and polynomial models (e.g., Hurley and Johnson 1994; Yao 1997; Jennergen 2013) or continuous-time models (e.g., Goldstein et al. 2001; Ju and Ou-Yang 2006; Titman and Tsyplakov 2007).

These fundamental considerations provide only a brief overview of the integration of the risk of default in valuation. However, it is beyond the scope of this study to analyze in

¹⁶ For the irrelevance of capital structure and dividend policy for the value of the firm with corporate and personal taxes in the market equilibrium, see DeAngelo and Masulis (1980) and Miller (1977). For empirical analyses of the relevance of personal taxes for valuation, see e.g., Chang and Rhee (1990) and Lin and Fleming (2013).

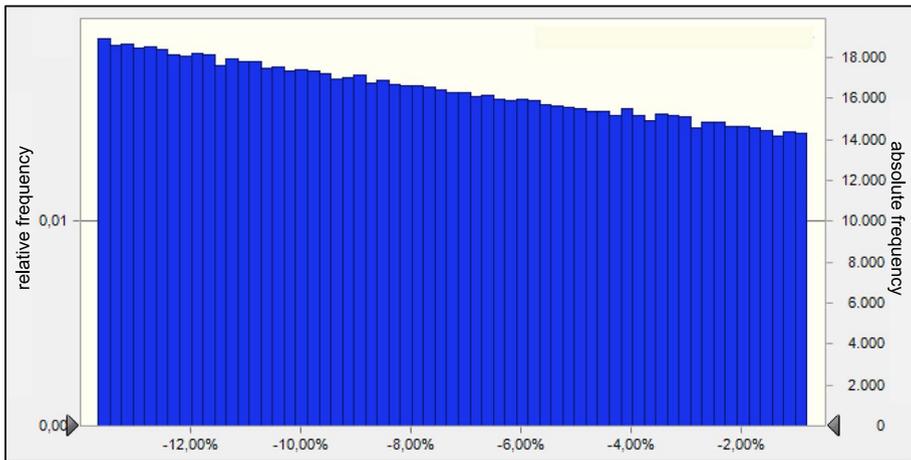


Fig. 1 Frequency distribution of percentage valuation difference

detail how the risk of default can be integrated into the valuation approaches. We laid the groundwork for an analysis of valuation with personal taxes and share repurchases under passive debt management, assuming risk-free debt. For the valuation practice, we recommend using the risk-adjusted cost of debt instead of the risk-free interest rate like Dempsey (2017) in his analysis integrating personal taxes in the discounting cash flow methods with a blended tax rate on cash dividends and capital gains. After all, the sound integration of the risk of default in valuation is not a problem specific to our analysis but applies to all valuation approaches with or without personal taxes under passive or active debt management or any other financing strategy.

7 Conclusions

When incorporating personal taxes in DCF models, the dividend policy affects equity market value, as the cash dividend tax rate exceeds the effective capital gains tax rate in many countries. Consequently, the equity market value increases the more the firm engages in retaining cash flows. Thus, the main results of this paper are the proposed valuation models, which allow considering the firm's dividend policy over an explicit forecast period and a subsequent steady state under passive debt management. Specifically, we derive a blended personal tax rate, encapsulating all the effects resulting from retentions and cash dividends. By specifying the blended personal tax rate, we can actually apply the proposed valuation models. Furthermore, we reveal the impact of the dividend policy on the cost of equity by deriving appropriate adjustment formulas for the relationship between the firm's unlevered and levered costs of equity while assuming both an explicit forecast period and a steady state. On the basis of adjustment formulae for the cost of equity, one can easily derive the adjustment formulae for equity beta. As special cases of our general valuation model, we can analyze the consequences of a dividends-only strategy and a share repurchases-only strategy in one period or all periods.

Conceptually, the FtE and APV approaches derived by Dempsey (2017) can be converted and specified to the FtE and APV approaches in this study under the assumptions

of passive debt management and uniform blended personal tax rates. Specifically, the use of the blended personal tax rate results in modified cost of equities. In this respect, our approaches open the possibility for a more differentiated valuation approach, especially concerning the effects of dividend policy on cash flows, tax shields, and cost of equity. This seems even more desirable, as our simulation results show that the value contribution of the chosen dividend policy of a firm on its equity market value is far from negligible: the average equity market value underestimation is approximately 7.6% if the valuation model assumes the full distribution of the FtE to the equity investors.

Finally, further theoretical research could focus on other assumptions about the dividend policy. Moreover, we restricted our analysis, like other basic analyses of valuation, to the case of risk-free debt. Nevertheless, by using a risk-adjusted cost of debt instead of the risk-free interest rate, our valuation approach can be easily adjusted to risky debt. However, from a theoretical perspective, this pragmatic solution is insufficient, especially in the case of higher risk for debt investors. Therefore, it would be interesting to analyze the effects of financial distress on the developed valuation model in detail.

Appendix

Appendix 1: Derivation of the market value of tax shields over the explicit forecast period

To derive the market value of tax shields, we start with the expected tax shield, $E[\widetilde{TS}_t]$, as the sum of the FtE and flow to debt minus the respective free cash flow after personal taxes:

$$\begin{aligned}
 E[\widetilde{TS}_t] = & \overbrace{(E[\widetilde{FCF}_t] - kd \cdot D_{t-1} \cdot (1 - \tau) + \Delta D_t) \cdot (1 - r_t \cdot \tau_d - (1 - r_t) \cdot \tau_g) - \tau_g \cdot (E[\widetilde{E}_t^{\ell}] - E[\widetilde{E}_{t-1}^{\ell}])}^{\text{flow to equity after personal taxes}} \\
 & + \overbrace{kd \cdot D_{t-1} \cdot (1 - \tau_b) - \Delta D_t}^{\text{flow to debt after personal taxes}} \\
 & - \overbrace{(E[\widetilde{FCF}_t] \cdot (1 - r_t \cdot \tau_d - (1 - r_t) \cdot \tau_g) - \tau_g \cdot (E[\widetilde{V}_t^u] - E[\widetilde{V}_{t-1}^u]))}^{\text{free cash flow after personal taxes}}.
 \end{aligned} \tag{17}$$

Since $E[\widetilde{E}_{t-1}^{\ell}] = E[\widetilde{V}_{t-1}^{\ell}] - D_{t-1} = E[\widetilde{V}_{t-1}^u] + VTS_{t-1} - D_{t-1}$, we obtain:

$$\begin{aligned}
 TS_t = & (-kd \cdot D_{t-1} \cdot (1 - \tau) + \Delta D_t) \cdot (1 - r_t \cdot \tau_d - (1 - r_t) \cdot \tau_g) \\
 & + kd \cdot D_{t-1} \cdot (1 - \tau_b) - \Delta D_t \cdot (1 - \tau_g) - \tau_g \cdot (VTS_t - VTS_{t-1}).
 \end{aligned} \tag{18}$$

Discounting each component in (18) with $1 + kd \cdot (1 - \tau_b)$ yields:

$$\begin{aligned}
 VTS_{t-1} = & \frac{(-kd \cdot D_{t-1} \cdot (1 - \tau) + \Delta D_t) \cdot (1 - r_t \cdot \tau_d - (1 - r_t) \cdot \tau_g)}{1 + kd \cdot (1 - \tau_b)} \\
 & + \frac{kd \cdot D_{t-1} \cdot (1 - \tau_b) - \Delta D_t \cdot (1 - \tau_g) - \tau_g \cdot (VTS_t - VTS_{t-1})}{1 + kd \cdot (1 - \tau_b)}.
 \end{aligned} \tag{19}$$

Rearranging the terms, we obtain Eq. (9).

Appendix 2: Partial derivation of the modified tax shields in period t for the payout ratio

Given Eq. (10), the modified tax shields TS_t^* in period t in the explicit forecast period are determined as:

$$TS_t^* = \tau \cdot kd \cdot D_{t-1} \cdot (1 - \tau_{E,t}^r) - kd \cdot D_{t-1} \cdot (\tau_{b^*} - \tau_{E,t}^r) - \Delta D_t \cdot \tau_{E,t}^r. \quad (20)$$

The partial derivation of Eq. (20) for payout ratio r_t yields:

$$\frac{\partial TS_t^*}{\partial r_t} = (kd \cdot (1 - \tau) \cdot D_{t-1} - \Delta D_t) \cdot \frac{\tau_d - \tau_g}{1 - \tau_g}. \quad (21)$$

Under assumption $\tau_d > \tau_g$, the direction of the partial derivation in (21) depends on the magnitude of the change in debt market value ΔD_t over period t . For $\Delta D_t < 0$ (redemption of debt) (21) is above zero and, consequently, indicates that the higher the payout ratio, r_t , is, the higher are the modified tax shields. Conversely, for positive changes in debt market value, which fulfill $\Delta D_t > kd \cdot (1 - \tau) \cdot D_{t-1}$, (21) is smaller than zero and, consequently, indicates that the higher the payout ratio, r_t , is, the lower are the modified tax shields.

As $\Delta D_{T+1} = g \cdot D_T$ holds in a steady state, we can rearrange (21) to obtain:

$$\frac{\partial TS_{T+1}^*}{\partial r} = D_T \cdot (kd \cdot (1 - \tau) - g) \cdot \frac{\tau_d - \tau_g}{1 - \tau_g} > 0. \quad (22)$$

Typically, $(kd \cdot (1 - \tau) - g) > 0$ holds, so that in a steady state, the higher the payout ratio, r , is, the higher are the modified tax shields.

Appendix 3: Derivation of the market value of tax shields in the steady state

In a steady state, Eq. (19) can be expressed as:

$$VTS_T = \frac{(-kd \cdot D_T \cdot (1 - \tau) + g \cdot D_T) \cdot (1 - r \cdot \tau_d - (1 - r) \cdot \tau_g)}{1 + kd \cdot (1 - \tau_b)} + \frac{kd \cdot D_T \cdot (1 - \tau_b) - g \cdot D_T \cdot (1 - \tau_g) - \tau_g \cdot g \cdot VTS_T + VTS_T \cdot (1 + g)}{1 + kd \cdot (1 - \tau_b)}. \quad (23)$$

Solving the circularity problems, rearranging terms, and dividing the numerator and denominator by $(1 - \tau_g)$ yields Eq. (11).

Appendix 4: Derivation of the cost of equity over the explicit forecast period

Solving Eq. (3) for the free cash flow after blended personal taxes yields:

$$E[\widetilde{FCF}_t] \cdot (1 - \tau_{E,t}) = E[\widetilde{V}_{t-1}^u] \cdot (1 + ke^{u^*}) - E[\widetilde{V}_t^u]. \quad (24)$$

Furthermore, solving (7) for $1 + ke^{u^*}$ and inserting (24) yields:

$$1 + ke_t^{\ell^*} = \frac{E[\tilde{V}_{t-1}^u] \cdot (1 + ke^{u^*}) - E[\tilde{V}_t^u] + (\tau \cdot kd \cdot D_{t-1} - kd \cdot D_{t-1} + D_t - D_{t-1}) \cdot (1 - \tau_{E,t}) + E[\tilde{E}_t^{\ell^*}]}{E[\tilde{E}_{t-1}^{\ell^*}]}. \quad (25)$$

Value additivity leads to:

$$E[\tilde{V}_t^u] = E[\tilde{E}_t^{\ell^*}] + D_t - VTS_t. \quad (26)$$

Inserting (26) in (25) and rearranging the terms yields:

$$ke_t^{\ell^*} = ke^{u^*} + \frac{(D_{t-1} - VTS_{t-1}) \cdot (1 + ke^{u^*}) - D_t \cdot \tau_{E,t}}{E[\tilde{E}_{t-1}^{\ell^*}]} + \frac{(\tau \cdot kd \cdot D_{t-1} - kd \cdot D_{t-1} - D_{t-1}) \cdot (1 - \tau_{E,t}) + VTS_t}{E[\tilde{E}_{t-1}^{\ell^*}]}. \quad (27)$$

Solving (10) for VTS_t and inserting it in (27), rearranging the terms, and multiplying with $(1 - \tau_g)$ finally yields (13).

Appendix 5: Further simplification of the adjustment formula in a steady state according to (13)

The further simplification of Eq. (13) yields:

$$ke^{\ell^*} = ke^u + (ke^u - kd \cdot (1 - \tau_b)) \cdot \frac{kd \cdot (1 - \tau) - g}{kd \cdot (1 - \tau_{b^*}) - g} \cdot \frac{D_T}{E[\widetilde{FtE}_{T+1}]} / (ke^{\ell^*} - g). \quad (28)$$

Note that Eq. (28) is independent of payout ratio r .

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Declarations

Conflict of interest The authors have no competing interests to declare that are relevant to the content of this article.

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